"the coolness of the wind and that of the atmosphere after the storm is over is hardly to be accounted for otherwise than by supposing that rain is always formed in the cloud overhead, but is re-evaporated before it reaches the earth."

There is nothing inconsistent in the existence of an excessive pressure at the ground surface beneath a thunder-storm and a diminished pressure in the vortex of the storm-cloud, but in ordinary thunder and hail storms this latter is restricted to the cloud-region. As the barograph traces of these storms show, the oscillations of pressure beneath them are very great, and there may and indeed must be still greater differences between the tornado vortex and the neighbouring region of precipitation. Indeed, the great velocity of the air-movement implies as much.

A part of Ferrel's theory which especially stands in need of confirmation is the assumption that, immediately prior to the formation of the vortex, the vertical distribution of temperature is such as to bring the atmosphere into a state of unstable equilibrium, and that a slight casual local disturbance of this equilibrium starts the vortical uprush. This is also his explanation of cyclone generation, and indeed it is that hitherto held by the majority of writers on the subject. On the other hand, it is generally considered that anticyclones are determined by the greater local density of the atmosphere, due to a low mean temperature of the air-column. The last of these assumptions, even in the case of winter anticyclones accompanied by very low temperatures at the ground surface, has now been conclusively disproved by Prof. Hann, of Vienna; and he has also shown very strong reasons for believing that the temperature conditions of extra-tropical cyclones are also incompatible with the prevailing view. It does not, of course, follow that those of tornadoes and hail-storms are equally so, but at least the assumed conditions require verification. This may, perhaps, be some day effected by our mountain observatories.

H. F. B.

OUR BOOK SHELF.

Inorganic Chemistry: the Chemistry of the Non-Metals. By J. Oakley Beuttler, M.A. (London: Relfe Brothers.)

NOW that there can be obtained a considerable variety of really good text-books of elementary chemistry suitable for all the usual needs of the present day, one is entitled to look for special features in any new manual. We fail to find any reason for the existence of the volume before us: wherein it differs from others that enjoy general recognition, it is incomplete and erroneous. It has neither index nor contents table, but this is quite a trivial matter when compared with the imperfections of the body of the work. On pp. 19 and 20 there are nine attempts at equations, none of which are correct, while many represent impossible or at least unknown reactions; and in the following paragraphs, on graphic notation, bonds, and radicles, there is a collection of statements that read like the imperfect recollections of a student who never understood the subject. A single atom of oxygen is shown with curiously shaped projections as an example of an element with an even number of bonds existing as a single "atom-molecule." It is stated emphatically that "the element having the greatest number of bonds is always printed in thick type," but we search in vain for thick type in any formula in the book. The statements that are intended to convey the facts of chemistry are vague, often misleading, and very rarely of a practical character. For an illustration of the style there is no need to go further than the chapter that treats of the first element, hydrogen. It states that "on throwing a piece of sodium into water the sodium combines with part of the hydrogen of the water to form caustic soda, liberating the other part of the hydrogen." The volume closes, as one would expect, with the questions set by various examining bodies during the last three or four years.

Anatomy, Descriptive and Surgical. By Henry Gray, F.R.S. Twelfth Edition. Edited by T. Pickering Pick. (London: Longmans, Green, and Co., 1890).

OF a solid text-book so well known as the present work it is hardly necessary to say more than that a new edition has appeared. The book has been carefully revised, and the editor has added considerably to its value by introducing sections on topographical anatomy, and amplifying those on surgical anatomy. Both of these classes of sections have been printed in smaller type, so that they may be disregarded by students who wish to confine their attention exclusively to the descriptive part of the subject. There are many new illustrations, some of which are original.

The Story of the Heavens. By Sir Robert Stawell Ball, LL.D. Fifteenth Thousand. (London: Cassell and Co., 1890.)

IT is, for many reasons, satisfactory that there should be a popular demand for a clear, brightly-written work on astronomy. Sir Robert Ball, however, ought hardly to be content with the issue of mere reprints of his book. It may be somewhat misleading to send forth in its original form, in 1890, an astronomical work first published in 1886.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Passage of Electricity through Gases.

IN my letter in NATURE of July 24 (p. 295) I objected to Prof. Schuster's statement that the fact that free atoms must turn a gas into a conductor of electricity was fatal to the theory of the electric discharge given by me in the *Philosophical Magazine* in 1883, and I maintained that the presence of free atoms in a gas free from electric strain was in no way essential to the theory given in that paper. I see no reason, after reading Prof. Schuster's letter in this week's NATURE, to change that opinion. Prof. Schuster bases his statement, not on my description of the theory itself, but on the explanation by it of the weakening of the electric strength produced by a diminution in the density of the gas. A reference to this explanation will show, however, that it really rests solely on the well-known fact that dissociation is assisted by diminution of pressure, and that the passage which Prof. Schuster quotes is merely an explanation of this property of dissociation from the point of view of the kinetic theory of gases; if this explanation is held to be inconsistent with the absence of free atoms from gas in a normal state, then any alteration in the explanation which might be made to meet this difficulty, though of primary importance in the kinetic theory of gases, is only of secondary importance for the theory of the electric discharge given in my paper, which I still maintain is not all bound up with the existence or non-existence of free atoms in gases not in the electric field. J. J. THOMSON.

Cambridge, October 18.

Changing the Apparent Direction of Rotation.

IN NATURE of October 16 (p. 585), a curious optical effect is incidentally mentioned. Standing near a windmill, and nearly

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in the plane of the sails, "it is possible, by a slight mental effort, to change the apparent direction of rotation, and back again."

A similar effect I have often observed, but it seems in no way dependent on the will. Look, for say 30 seconds, steadily at the revolving disks of an anemometer; they will soon reverse their apparent direction, whether you wish it or not. Continue still to gaze, and that reversed direction will be changed back.

All whom I have asked to try this experiment felt the effect to be involuntary. The changes take place not gradually or confusedly, but distinctly and with decision. The fact is plain; the explanation not so simple. HERCULES MACDONNELL.

4 Roby Place, Kingstown.

Earthquake Tremors.

PERMIT me to say that Mr. John Perry, in his criticism (October 2, p. 545) of my "Method of observing the Phenomena of Earthquakes," has assumed that the phenomena observed were due to vertical displacement; whereas they were probably due to a swaying of the building in which the observations were made.

This assumption seems also to have been made in the case of the man mentioned by Mr. Wire in your last issue (p. 593).

Marine Villa, Shanklin, I.W., H. G. DIXON.
October 18.

A Ball of Fire.

AT about 12.5 last night I was going through the street at Milverton, and saw a bright light about south of me. I saw also a bright ball of fire appear through a break in the clouds proceeding with great rapidity, at about the height of 45°, in a direction which I estimate to be from south to north-north-east; it disappeared behind a church, and I saw nothing more. I am told this may be of interest, and therefore forward the account to you. CHARLES RANDOLPH.

Milverton, Somerset, October 17.

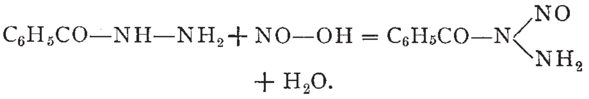
HYDRAZOIC ACID—A NEW GAS.

A NEW gaseous compound of nitrogen and hydrogen has been obtained by Dr. Theodore Curtius, the discoverer of amidogen, and its nature and properties were described by him in the Chemical Section during the recent scientific meetings at Bremen. The composition of the gas is HN_3, and its constitution $\mathrm{H{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right.$. It is, in fact, the hydrogen compound corresponding to the well-known diazobenzene imide of Griess, $\mathrm{C_6H_5N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right.$, the three nitrogen atoms being united in the form of a closed chain. The gas dissolves in water with great avidity, forming a solution which possesses strongly acid properties, and dissolves many metals, such as zinc, copper, and iron, with evolution of hydrogen gas and formation of nitrides, the metal taking the place of the liberated hydrogen. The derivation name of the gas, azoimide, is somewhat unfortunate in view of its strongly acid nature, and Prof. Curtius proposes the name "Stickstoffwasserstoffsäure." Perhaps the nearest English equivalent, open to the least objection, is hydrazoic acid—a name which will serve to recall the many analogies which this acid bears to hydrochloric and the other halogen acids.

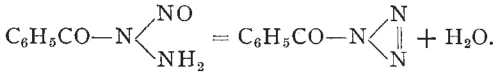
In studying the reactions of his recently-discovered hydrazine (amidogen) hydrate, $N_2H_4 . H_2O$, Dr. Curtius found that benzoylglycollic acid, $C_6H_5CO{-}O{-}CH_2COOH$, was decomposed by two molecules of hydrazine hydrate, with elimination of water and formation of benzoylhydrazine, $C_6H_5CO{-}NH{-}NH_2$, and hydrazine acetic acid, $NH_2{-}NH{-}CH_2COOH$, in accordance with the equation—

$$C_6H_5CO{-}O{-}CH_2COOH + 2N_2H_4 =$$
$$C_6H_5CO{-}NH{-}NH_2 + NH_2{-}NH{-}CH_2COOH + H_2O.$$

Under the influence of nitrous acid benzoylhydrazine forms a nitroso compound, $\mathrm{C_6H_5CO{-}N}\left\langle\begin{matrix}\mathrm{NO}\\ \mathrm{NH_2}\end{matrix}\right.$, which spontaneously changes into benzoyl-azo-imide, $\mathrm{C_6H_5CO{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right.$, with elimination of water.

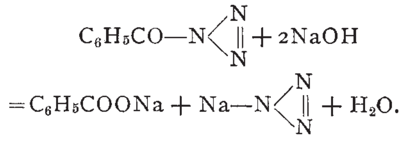


$$\mathrm{C_6H_5CO{-}NH{-}NH_2 + NO{-}OH = C_6H_5CO{-}N}\left\langle\begin{matrix}\mathrm{NO}\\ \mathrm{NH_2}\end{matrix}\right. + \mathrm{H_2O}.$$



$$\mathrm{C_6H_5CO{-}N}\left\langle\begin{matrix}\mathrm{NO}\\ \mathrm{NH_2}\end{matrix}\right. = \mathrm{C_6H_5CO{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right. + \mathrm{H_2O}.$$

Benzoyl-azo-imide decomposes, upon boiling with alkalies, with formation of benzoate of the alkali and the alkaline salt of the new acid.



$$\mathrm{C_6H_5CO{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right. + \mathrm{2NaOH}$$
$$= \mathrm{C_6H_5COONa + Na{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right. + \mathrm{H_2O}.$$

When this sodium nitride is warmed with sulphuric acid, hydrazoic acid, $\mathrm{H{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right.$, is liberated as a gas. The gas is decomposed by hot concentrated oil of vitriol; hence diluted acid requires to be employed, and the gas can thus only be collected in a moist state. HN_3 possesses a fearfully penetrating odour, producing violent catarrh, and dissolves in water with an avidity reminding one of hydrochloric acid. The solution also bears a surprising resemblance to aqueous hydrochloric acid; for, on distillation a concentrated acid first passes over, and afterwards a more dilute acid of constant composition. The aqueous solution possesses the odour of the free gas, and is strongly acid to litmus. With ammonia gas, hydrazoic acid gas forms dense white fumes of the ammonium salt, N_4H_4 or $\mathrm{NH_4{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right.$, a compound which is completely volatile below 100°, and which crystallizes, but not in crystals belonging to the cubic system, in this respect indicating its different constitution to ammonium chloride. The aqueous solution rapidly evolves hydrogen in contact with zinc, copper, iron, and many other metals, even when largely diluted. As in the case of hydrochloric acid, the silver and mercurous salts are insoluble in water, the others being generally readily soluble. As the acid possesses feebly reducing properties, solutions of many of its metallic salts, the copper salt for instance, yield precipitates upon boiling of compounds of the lower oxides of the metals. The barium salt, BaN_6, crystallizes from solution in large brilliant anhydrous crystals. With silver nitrate the aqueous solution of the acid or a soluble salt yields a precipitate closely resembling silver chloride in appearance. Silver nitride, $\mathrm{Ag{-}N}\left\langle\begin{matrix}\mathrm{N}\\ \| \\ \mathrm{N}\end{matrix}\right.$, does not, however, darken when exposed to light, and is further distinguished from silver chloride by its fearfully explosive properties. During the course of his description at Bremen, Prof. Curtius placed a quantity of this salt less than 0·001 gram in weight upon an iron plate, and then touched it with a heated glass rod. A sharp and loud detonation resulted, and the plate was considerably distorted. The mercurous salt, Hg_2N_6, is likewise very explosive. The metallic salts are readily converted into

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